REMOTE SENSING APPLICATIONS OF THE EXTENDED RADIOSITY METHOD

by

C.C. Borel and S.A.W. Gerstl

Space Science & Technology, SST-8, MS D438
Los Alamos National Laboratory
Los Alamos, New Mexico 87545, USA

Content

RSS Activity Summary

NASA's Remote Sensing Science (RSS) program activities in applications of the radiosity method in remote sensing :

Past Activities

- Applications of the radiosity method in remote sensing

- Modeling the scattering of light inside vegetative canopies

- Program was written to solve the radiosity equations for the scattering of light from many scattering leaves above a ground surface

- Developed methods to compute the bidirectional reflectance distribution function (BRDF) of canopies (Borel et al, RSE-91)

- Conducted reflectance measurements on an artificial plant canopy composed of 12000 circular disks that simulate leaves (2 papers in preparation)

- Measurements showed good agreement with the radiosity calculation

- Apply extended radiosity method to scattering medium above reflecting surface to model surface-atmosphere, atmosphere-surface and atmosphere-atmosphere scattering (Borel and Gerstl, SPIE'91)

- Model the scattering between a surface and a scattering or volumetric medium to represent an atmosphere

- Using the extended radiosity method we were able to formulate a method to compute the point spread function for any view direction and with height-dependent atmospheric scattering parameters and phase functions (Borel and Gerstl, SPIE'92)

- Using an inverse filtering method we were able to sharpen images blurred by the adjacency effect (Borel and Gerstl, IGARSS'92 - Thu afternoon (4 th paper), Pasadena)

- We are currently developing hyperspectral applications (non-linear spectral mixing) of the radiosity method for EOS-sensed vegetated and bare surfaces with imaging spectrometers (1 paper to be submitted to RSE)

Ongoing / Future Work :

- Develop simpler, though still radiosity based plant canopy models for inversion and sensitivity analysis

- Develop hyperspectral canopy models for EOS-HIRIS canopy chemistry sensing initiative

- Algorithms to compute radiosity solutions for digital terrain models (surface-surface scattering)

- Include BRDFs in radiosity calculations using spherical harmonics to express the BRDFs and the radiosity at each surface.

- Integrate various applications of the radiosity method into a simulation program which computes the surface-surface, surface-volume, volume-surface and volume-volume interactions that are of importance in remote sensing.